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AUTHOR Mayes, Annette G.; Roberts, Adrian R.
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ABSTRACT

To examine the cognitive strengths and weaknesses of learning disabled (LD) students, WISC-R (Weschler Intelligence Scale for Children-Revised) subtest scores of 309 kindergarten through sixth grade LD students were analyzed. The 10 subtests were the information, similarities, arithmetic, vocabulary, comprehension, picture completion, picture arangement, block design, object assembly, and coding subtests. Findings are summarized for the total population, for males and females, whites and nonwhites, students in K-3 and 4-6. Among major findings were that: with few exceptions, the mean scale scores to the 10 subtests for all populations were below average; overall, LD Ss made higher scores on performance than on verbal subtests; generally, mean scores for the subpopulations were highest for picture arrangement, picture completion, and object assembly; LD Ss in K-3 scored significantly higher than LD Ss in 4-6 on vocabulary and comprehension subtests; males scored significantly higher than females on picture completion and object assembly while females scored higher on the coding subtest; and, with the exception of the arithmetic and coding test, white Ss scored significantly higher than did nonwhites. (CL)

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A STUDY OF WISC-R SUBTEST SCORES OF LEARNING DISABLED STUDENTS

BY

Dr. Annette G. Mayes
Associate Professor of Education
North Carolina Central University

and

Dr. Adrian R. Roberts
Associate Professor of Education
North Carolina Central University

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A STUDY OF WISC-R SUBTEST SCORES OF LEARNING DISABLED STUDENTS

Introduction

The purpose of this study was to obtain insight into the cognitive strengths and weaknesses of learning disabled students. This purpose was accomplished by analyzing WISC-R subtest scores obtained on 309 students in kindergarten through grade six in the Durham County Public Schools in North Carolina. Specific objectives of the study were as follows:

- To determine whether there were significant differences among the ten scale scores for the 309 students for whom WISC-R scores were recorded.
- To determine if there were significant differences between the scale scores observed for male and female students.
- To determine whether there were significant differences between the scale scores observed for white and nonwhite students.
- To determine whether there were significant differences between the scale scores observed for students who were administered the tests while in grades K-3 and grades 4-6.

When significant differences were observed between subtest scale scores for the total study population, interpretations are made in reference to the interpretative hypotheses tested by Sattler (1982). Sattler recommends that his hypotheses be treated as tentative and formulated in relation to an individual's absolute scale scores rather than as "verified insights." Attention is directed that interpretations in this study are not made in reference to the scale scores for one student but the average scale scores for 309 students.

A t test was used to determine whether there were significant differences between mean scale scores. Observed differences were considered significant at the 95 percent probability level.

Study Population

WISC-R scores for this study were obtained for 309 students in grades K-6 who had been identified as learning disabled children. Of the 309 students, 208 were males and 101 were females; 167 were white students, and 142 were nonwhite students; and 198 were tested while in grades K-3 and 111 were tested while in grades 4-6. The proportions of male and nonwhite students in this learning disabled population are much larger than the proportions of male and nonwhite students in the total student population in the Durham County Schools. The criteria for placing students in the Durham County Schools in the learning disabled program are as follows:

> "Pupils who exhibit a specific learning disability, have at least average intellectual ability, or are capable of average intellectual ability. These pupils manifest a significant discrepancy between their current educational placement and their current performance. This discrepancy is the result of a deficiency in prerequisite skills and/or performance necessary in the academic areas of reading, spelling, mathematics, or handwriting. These deficiencies cannot be attributed to the presence of visual/auditory or motor handicapping conditions, primary emotional disturbances, cultural, environmental, and economic disadvantage."

Descriptions of Subtests

A brief description of each of the subtests in the WISC-R and the extent that each subtest measures g is provided as background information. Spearman (1927) believed that a general factor, called g, plus one specific factor per test can account for performance on intelligence tests. Brief descriptions of the ten subtests - Sattler (1982) - follow:

1. INFORMATION. Information measures the wealth of available information acquired as a result of native ability and early cultural experience. Memory is an important aspect of performance on the subtest. The subtest ties with Similarities

as the second best measure of g, and contributes to the Verbal Comprehension factor.

2. SIMILARITIES. Similarities measures verbal concept formation and ties with Information as the second-best measure of g.

3. ARITHMETIC. Arithmetic measures numerical reasoning ability. It is a moderately good measure of g, and contributes to the Freedom from Distractibility and Verbal Comprehension factors.

4. VOCABULARY. Vocabulary measures a variety of functions, including language development, learning ability, and fund of information. The subtest is an excellent measure of g, and contributes to the Verbal Comprehension factor.

5. COMPREHENSION. Comprehension measures social judgement: the ability to use facts in a pertinent, meaningful, and emotionally appropriate manner. The subtest is a moderately good measure of g, and contributes to the Verbal Comprehension factor.

6. PICTURE COMPLETION. Picture Completion measures the ability to differentiate essential from nonessential details. It requires concentration, visual organization, and visual memory. The subtest is a fair measure of g, and contributes to the Perceptual Organization factor.

7. PICTURE ARRANGEMENT. Picture Arrangement measures nonverbal reasoning ability. It also may be viewed as a measure of planning ability, i.e., the ability to comprehend and size up a total situation. The subtest is a fair measure of g, and contributes to the Perceptual Organization factor.

8. BLOCK DESIGN. Block Design measures visual-motor coordination and perceptual organization. The subtest is the best single

measure of g among the Performance Scale subtests, and contributes to the Perceptual Organization factor.

9. OBJECT ASSEMBLY. Object Assembly measures perceptual organization ability. The subtest is a fair measure of g, and contributes to the Perceptual Organization factor.

10. CODING. Coding measures visual-motor coordination, speed of mental operation, and short-term memory. The subtest is the poorest measure of g in the scale, but it contributes to the Freedom from Distractibility factor.

The Findings

The following table presents the mean scale scores for the ten subtests of the WISC-R for the total study population (309), for male students (208), for female students (101), for white students (167), for nonwhite students (142), for students in K-3 (198), and for students in 4-6 (111). Scale scores on the WISC-R range from one (1) to 19. Ten represents an average scale score for a subtest, and 100 is average for all ten subtests.

In rank order, the mean scale scores for the ten subtests for the total study population were as follows: Picture Arrangement (9.9), Picture Completion (9.6), Object Assembly (9.2), Comprehension (8.9), Similarities (8.6), Vocabulary (8.3), Coding (8.1), Arithmetic (7.8), Block Design (7.7), and Information (7.4). The rank order of the mean scale scores for the ten subtests was generally the same for the six subpopulations as for the total study population. The most notable exception to this rule was associated with Coding. The mean scale score for Coding for the total population was the seventh highest score; whereas

Mean WISC-R Scale Scores for Subpopulations of Durham County Schools Learning Disability Students

WISC-R Subtests	Total N=309	Sex		Race		Grade Level	
		Male N=208	Female N=101	White N-167	Nonwhite N=142	K-3 N=198	4-6 N=111
Information	7.4	7.7	7.2	8.1	6.8	7.5	7.4
Similarities	8.6	8.9	8.2	9.1	8.2	8.8	8.4
Arithmetic	7.8	7.9	7.8	8.0	7.6	7.8	7.9
Vocabulary	8.3	8.5	8.1	8.9	7.9	8.8	7.7
Comprehension	8.9	9.0	8.9	9.3	8.6	9.3	8.5
Picture Completion	9.6	9.9	8.9	10.0	9.1	9.7	9.5
Picture Arrangement	9.9	10.0	9.8	10.3	9.5	9.8	10.3
Block Design	7.7	7.9	7.3	8.2	7.1	7.7	7.6
Object Assembly	9.2	9.6	8.4	9.7	8.6	9.2	9.2
Coding	8.1	7.7	8.9	7.9	8.4	8.2	8.0
Total	85.3	86.9	83.0	89.1	81.6	84.8	82.2

for males it was the tenth; for females, second; for whites, tenth; and for nonwhites, fifth.

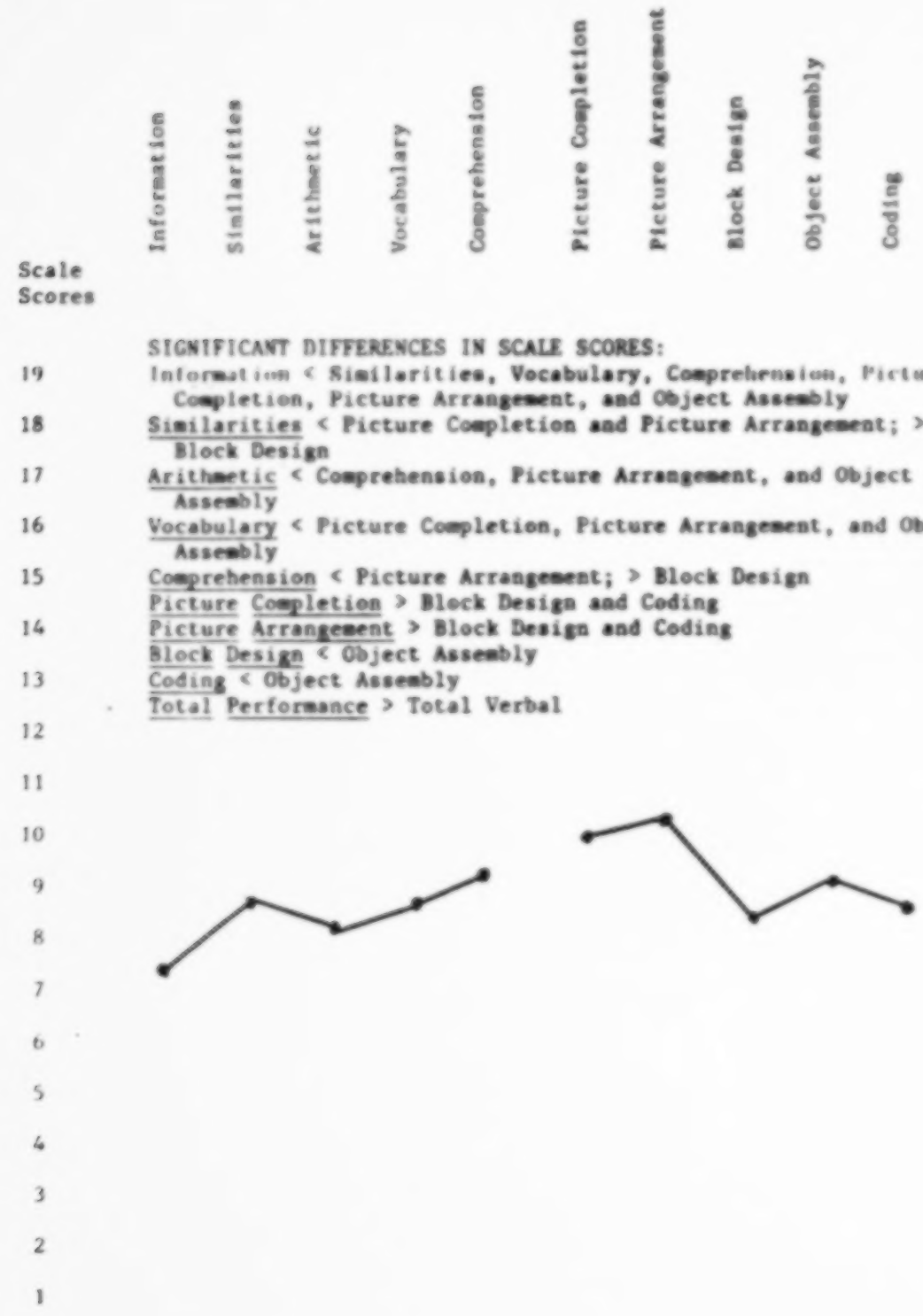
The total scale scores for all groups were far below 100 or average. The total mean scale scores were as follows: total population = 85.3, male students = 86.9, female students = 83.0, white students = 89.1, nonwhite students = 81.6, students in K-3 = 84.8, and students in 4-6 = 82.2.

Differences Between Scale Scores For Total Population

Figure 1 presents a graph of the mean scale scores for the ten subtests for the WISC-R for the total study population. T test analyses revealed that there were significant differences between the mean scale scores for the subtests which follow:

- Total Performance was greater than Total Verbal.
- Information less than Similarities, Vocabulary, Comprehension, Picture Completion, Picture Arrangement, and Object Assembly.
- Similarities less than Picture Completion and Picture Arrangement; greater than Block Design.
- Arithmetic less than Comprehension, Picture Arrangement, and Object Assembly.
- Vocabulary less than Picture Completion, Picture Arrangement, and Object Assembly.
- Comprehension less than Picture Arrangement; greater than Block Design.
- Picture Completion greater than Block Design and Coding.
- Picture Arrangement greater than Block Design and Coding.
- Block Design less than Object Assembly.

Figure 1
Mean WISC-R Scale Scores for Durham County Learning Disabled Students (N=309)



SIGNIFICANT DIFFERENCES IN SCALE SCORES:

Information < Similarities, Vocabulary, Comprehension, Picture Completion, Picture Arrangement, and Object Assembly

Similarities < Picture Completion and Picture Arrangement; > Block Design

Arithmetic < Comprehension, Picture Arrangement, and Object Assembly

Vocabulary < Picture Completion, Picture Arrangement, and Object Assembly

Comprehension < Picture Arrangement; > Block Design

Picture Completion > Block Design and Coding

Picture Arrangement > Block Design and Coding

Block Design < Object Assembly

Coding < Object Assembly

Total Performance > Total Verbal

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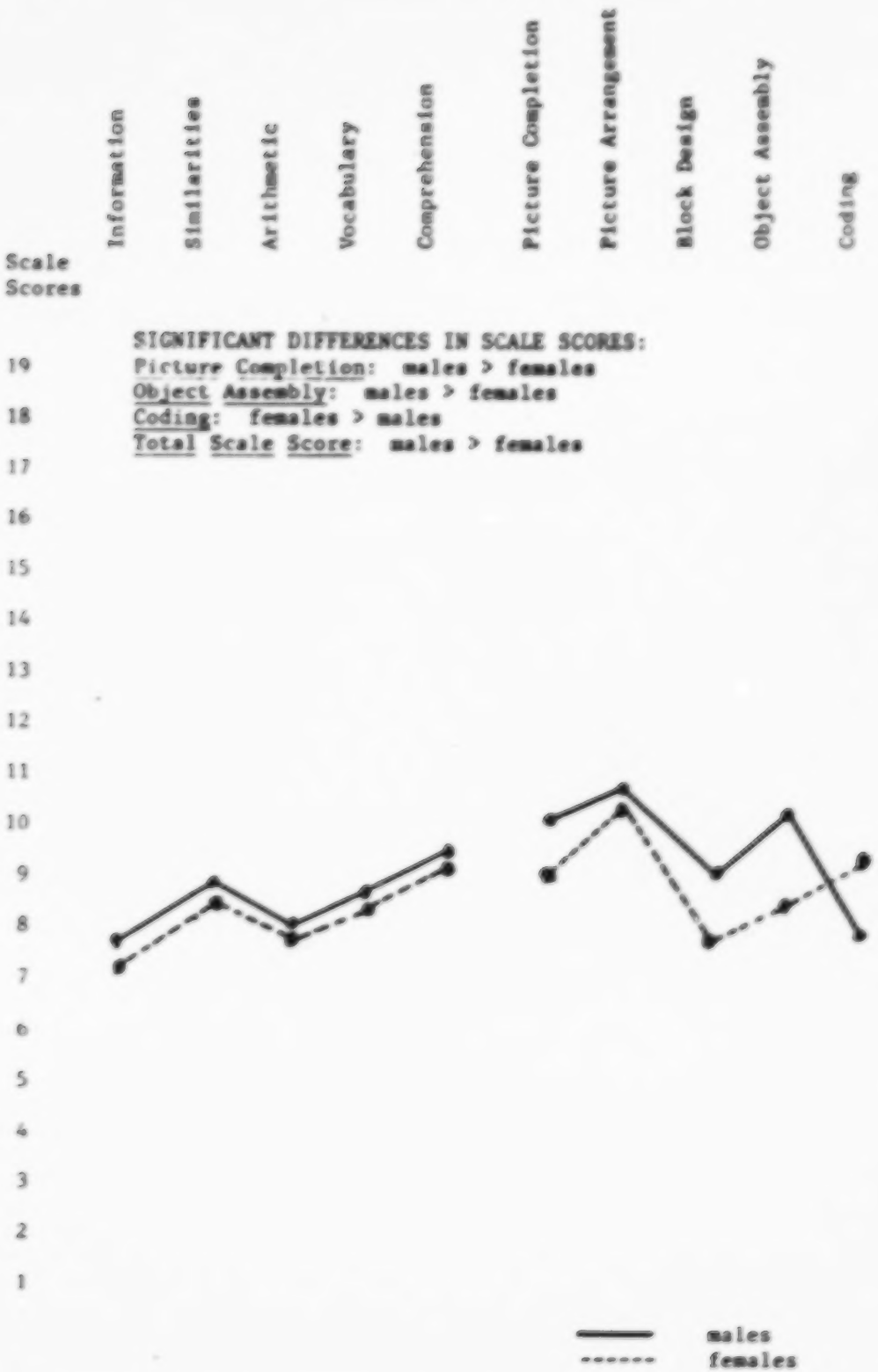
- Coding less than Object Assembly.

Using Sattler's (1982) hypotheses, the following interpretations may be drawn from the findings presented above:

1. Total Performance and Total Verbal. Total Performance greater than Total Verbal might indicate that (a) performance skills better developed than verbal skills; (b) visual nonverbal mode better developed than auditory processing mode; (c) possible difficulty with reading; (d) possible language deficit, and (e) possible limitation in auditory conceptual skills.
2. Information and Comprehension. This is a comparison of the amount of information retained (Information) and the ability to use information (Comprehension). Information requires factual knowledge, while Comprehension requires both factual knowledge and judgement. Low Information and high Comprehension may suggest that children have been limited in their exposure to factual material, but use their limited knowledge to make appropriate judgements.
3. Comprehension and Arithmetic. Both the Comprehension and Arithmetic subtests require reasoning ability or, more specifically, the ability to analyze a given set of material and then to recognize the elements that are needed for the solution of the specified problem. High Comprehension and low Arithmetic may suggest that reasoning ability is adequate in social situations but not in situations involving numbers.
4. Comprehension and Picture Arrangement. Both the Comprehension and Picture Arrangement subtests contain stimuli that are concerned with social interaction. Scores on the two subtests permit comparison of knowledge of social conventions (Comprehension) with the capacity to anticipate and plan in a social context (Picture Arrangement). High Picture Arrangement coupled with low Comprehension may indicate that the individuals are sensitive to interpersonal nuances, but disregard social conventions.
5. Picture Completion and Block Design. This comparison involves an estimate of visual perception versus visual-motor-spatial coordination. High Picture Completion and low Block Design may suggest that children have adequate nonspatial visual perceptual ability but have difficulty in spatial visualization.

Figure 2 presents a graph of the mean scale scores for the ten subtests of the WISC-R for male and female learning disabled students. With the exception of the Coding scale scores, the mean scale scores for male students are higher than the mean scale scores for female students.

Figure 2
Mean WISC-R Scale Scores for Male and Female Learning Disabled Students



Also, the curve (rise and fall) of scores are very similar except for the Coding score. The mean scale scores for males were significantly higher than the mean scale scores for females for the total scale score, Picture Completion, Object Assembly, and Coding.

With the exception of the Coding mean scale score, the patterns of the scale scores for the ten WISC-R subtests are similar for white and nonwhite students (Figure 3). The Coding mean scale score for nonwhite students was slightly higher than the Coding mean scale score for white students. White students, however, scored significantly higher than nonwhite students on the total scale score and all scale scores for the subtests except for Arithmetic and Coding.

Figure 4 presents a graph of the ten mean WISC-R scale scores for learning disabled students in grades K-3 and grades 4-6. The mean scale scores on the Vocabulary and Comprehension subtests were significantly higher for the students in K-3. The mean scale scores for the other eight subtests for the two categories of students were very similar.

Summary

The major findings in this study were as follows:

- With a few exceptions, the mean scale scores on the ten WISC-R subtests for all subpopulations in the study were below average or below 10.
- Overall the learning disabled students made the higher scores on the Performance subtests than on the Verbal subtests.
- Generally, the mean scores for the various subpopulations of students were highest for Picture Arrangement, Picture Completion, and Object Assembly; the mean scale scores were lowest for Information, Block Design, and Arithmetic.

Figure 3
Mean WISC-R Scale Scores For White and Nonwhite Learning Disabled Students

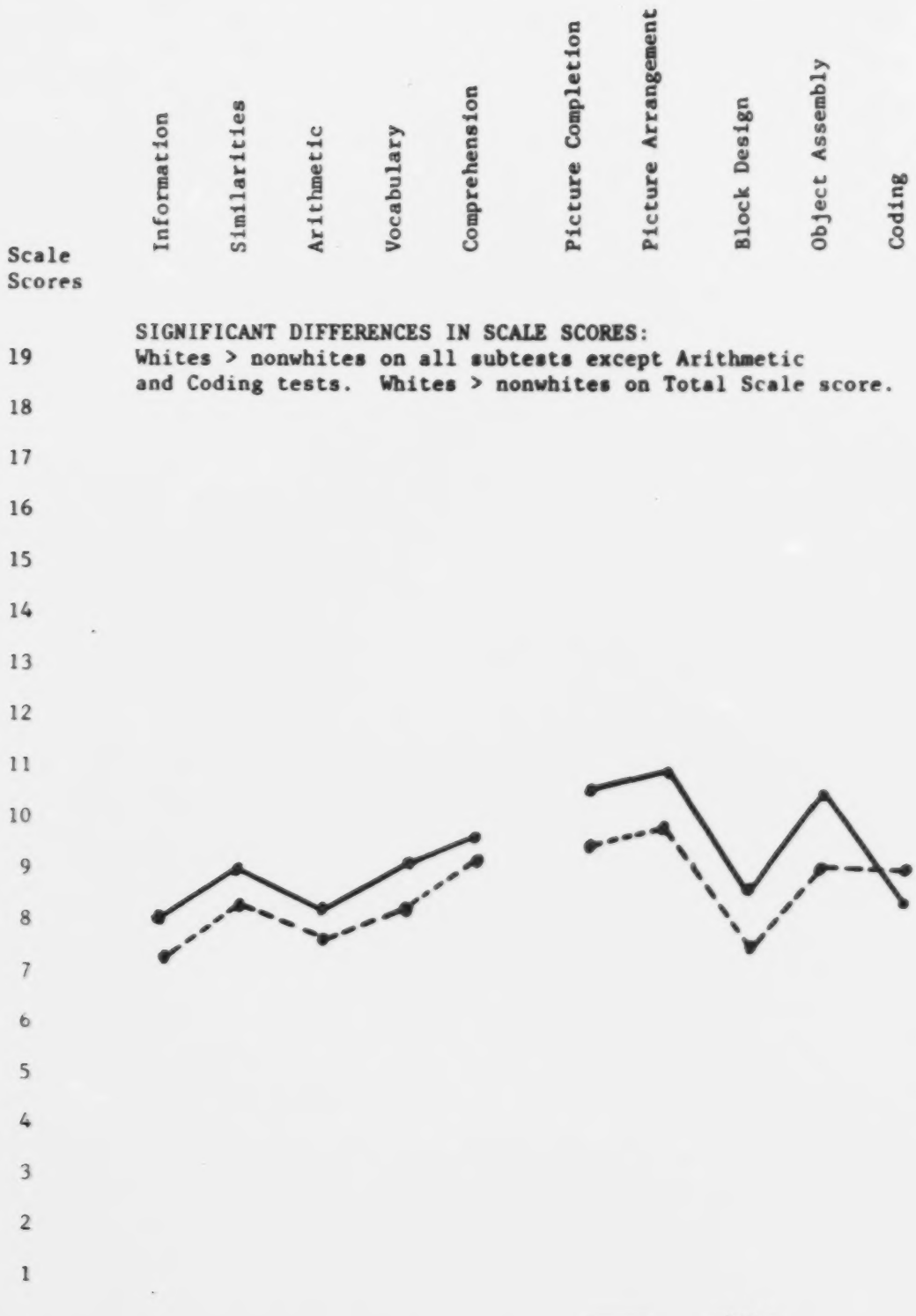
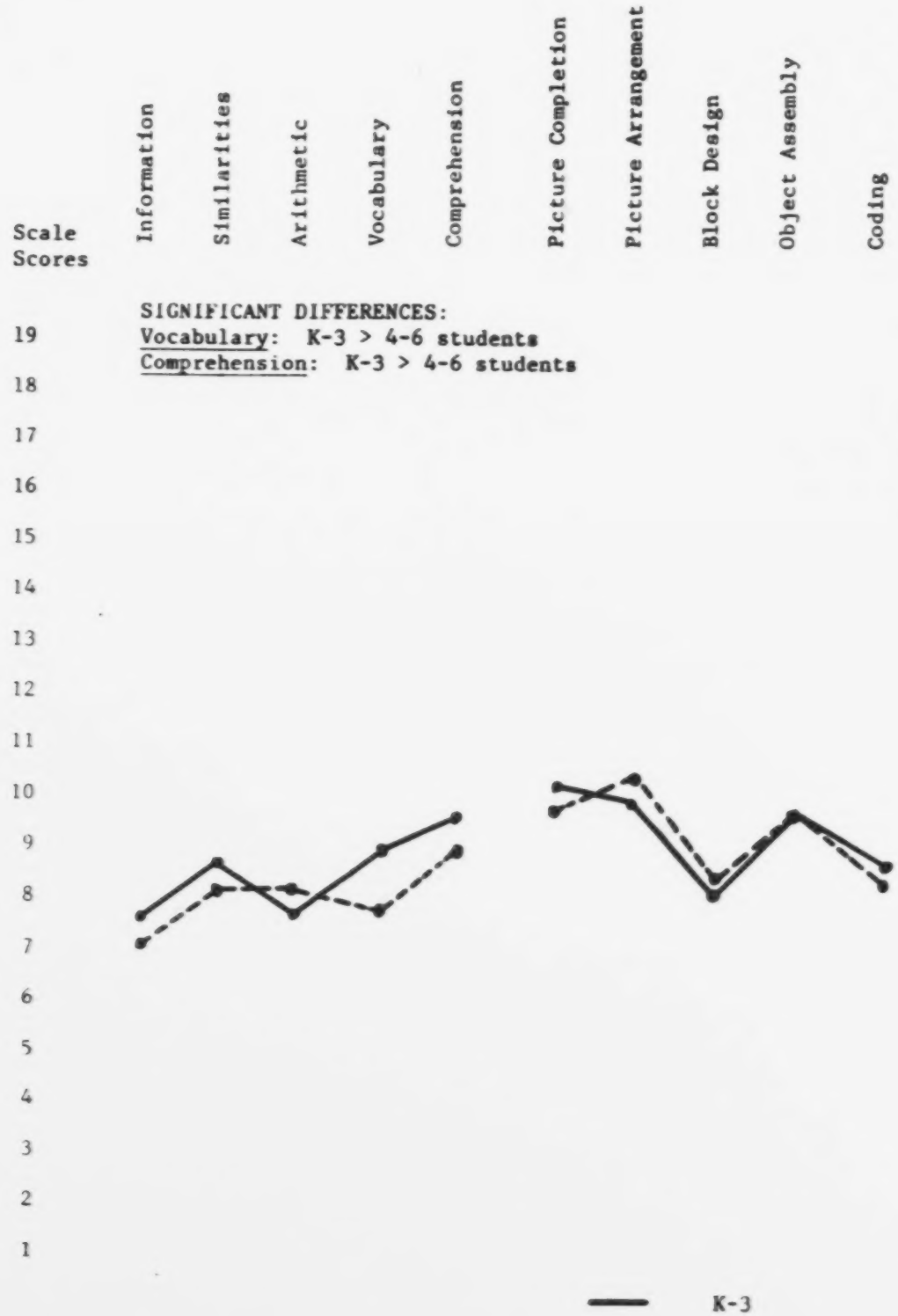


Figure 4
Mean WISC-R Scale Scores for Learning Disabled Students in Grades K-3 and Grades 4-6



- Coding scores were high for female students and low for male students and white students.
- Significant difference between mean tests (t tests) revealed that 23 pairs of means between the scale scores for the ten subtests were significantly different. Obviously, most of these differences were observed between the highest scale scores (Picture Arrangement, Picture Completion, and Object Assembly) and the lowest scale scores (Information, Block Design, Arithmetic, and Coding).
- Learning disabled students in K-3 scored significantly higher than learning disabled students in 4-6 on the Vocabulary and Comprehension tests of the WISC-R.
- With the exception of the Arithmetic and Coding tests, white learning disabled students scored significantly higher on the WISC-R subtests than did nonwhite learning disabled students.
- Male learning disabled students scored significantly higher than female learning disabled students on Picture Completion and Object Assembly; female students scored significantly higher than male students on the Coding test.

On the basis of Sattler's hypotheses concerning the interpretations about differences between subtest scale scores, the following points can be made:

1. The low Information and high Comprehension scores may suggest that the students in this study have been limited in their exposure to factual material but use their limited knowledge to make appropriate judgements.
2. High Comprehension and low Arithmetic scores may suggest that reasoning ability is adequate in social situations but not in situations involving numbers.

3. High Picture Arrangement scores coupled with low Comprehension scores suggest that the students are sensitive to interpersonal nuances but disregard social conventions.
4. High Picture Completion and low Block Design scores may indicate that the students have adequate nonspatial visual perceptual ability but have difficulty in spatial visualization.
5. A higher Object Assembly score than a Block Design score may suggest that nonverbal inductive reasoning skills are better developed than nonverbal deductive reasoning skills.
6. A higher Performance score than a Verbal score suggests that performance skills are better developed than verbal skills; that the visual nonverbal mode is better developed than the auditory processing mode; that there is a possible difficulty with reading; that there is a possible language deficit; and that there is a possible limitation in auditory conceptual skills.
7. Using Bannatyne's (1974) groupings of WISC-R subscores, both reading and learning disabled students scored high on Spatial, low on Sequencing, and low on Acquired Knowledge. Tests in the Spatial grouping include Picture Completion, Block Design, Object Assembly; tests in the Sequencing grouping, Arithmetic Digit Span, and Coding; and Acquired Knowledge, Information, Arithmetic, and Vocabulary. On tests in the Spatial grouping, Durham County learning disabled students were relatively high on Picture Completion and Object Assembly but low on Block Design; on tests in the Sequencing grouping, Durham County students were low on Arithmetic and Coding (Digit Span not administered); and in the Acquired Knowledge grouping, scored relatively low on Information and Arithmetic.

8. A number of studies confirmed this study's findings relative to the fact that learning disabled students made low scores on Information, Arithmetic, and Coding (Ackerman, Dykman, et al., 1976; Lutey, 1977; McManis, Figley, et al., 1978; Robeck, 1971; Rugel, 1974).

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